The American Woodcock In Pennsylvania

The American
WOODCOCK
in
Pennsylvania

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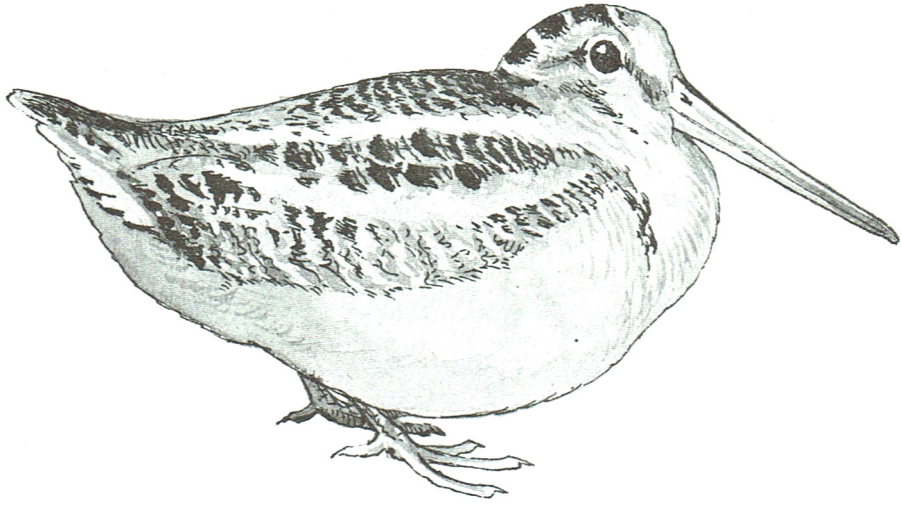
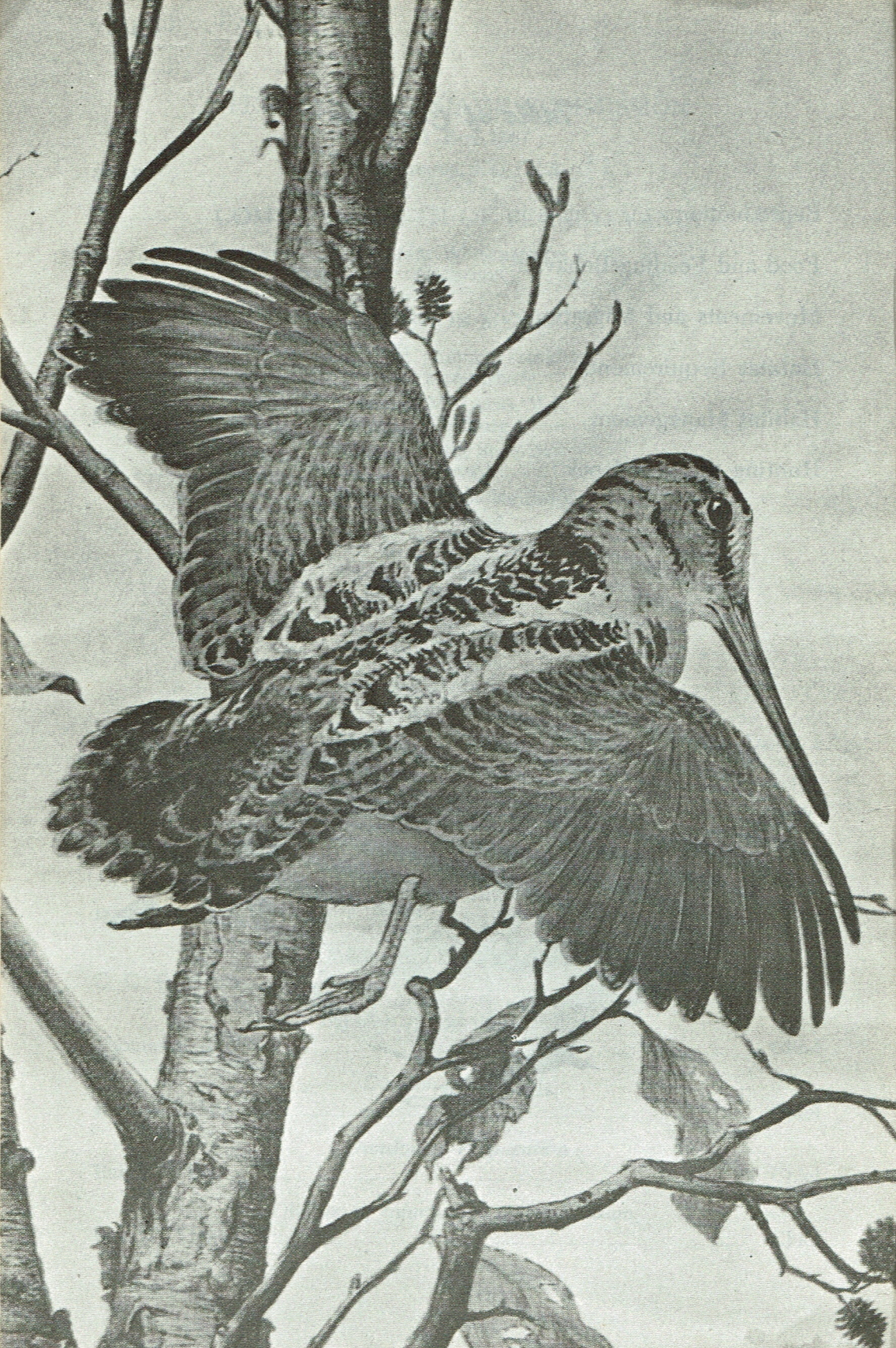




Introduction

The American woodcock is a bird which interests many people. The bird hunter finds it a very sporting target, while the nonhunter is intrigued by its peculiar habits. In Pennsylvania, the woodcock ranks high as a sporting bird, and the grouse hunter, especially, welcomes the woodcock in his trips afield. Many hunters depend on the "timberdoodle" (nickname for woodcock), when grouse are scarce, to train their bird dogs and to fill out their bag.

Although approximately 12,000 woodcock are taken by Pennsylvania hunters during the fall season, these birds are less abundant than in former years. In an effort to find out why the numbers of woodcock have been reduced in Pennsylvania in recent years, this study was initiated.

Early woodcock investigations in Pennsylvania and elsewhere were limited primarily to studies of the habits of this bird. These studies were, and still are, extremely important. Later surveys dealt with the factors which limited woodcock populations. The current Pennsylvania research has placed emphasis on management techniques. But in addition to the habitat management research, it was also necessary to conduct limited studies on the life history, ecology and populations of these birds.

The primary objectives of the project were:

(1) To ascertain the abundance and distribution of the woodcock in the Commonwealth.

(2) To determine the habitat requirements of woodcock.

(3) To formulate techniques for creating and improving woodcock habitat.

(4) To study the effect of hunting and other limiting factors on woodcock populations.

The following account is a popularized version of The Pennsylvania Woodcock Management Study, Pittman-Robertson Project W-50-R.

PGC Photo by the Author

AN INCUBATING HEN woodcock is well camouflaged in typical woodcock habitat.

REPRODUCTION

ONE of the most important factors in the perpetuation of a species is its capacity to reproduce. This factor is especially important in the case of woodcock. Unlike other game bird species, such as quail, pheasant and grouse, the reproductive potential of woodcock is relatively slow. The discussion which follows should serve to illustrate this fact, and to signify the need for its consideration in any woodcock management plan.

Replenishment of the coverts begins with the arrival of woodcock in late winter and early spring. After about four months on the wintering ranges in southern states, mainly Louisiana, woodcock are among the most eager and earliest of migrants returning to their breeding ranges. Arrival time in Pennsylvania begins as early as February 25 and continues for about a month thereafter. That woodcock return to the place of their birth and rearing has been well established.

Courtship and Breeding

Courtship and breeding begin immediately. The female of the species is attracted to the male by a rather spectacular courtship display. This display has been adequately described by many writers. Suffice it to say, at this time, that the courtship display consists of a number of spiraling aerial flights made at dawn and at dusk from a clearing commonly called a "singing field." It should be mentioned in passing that woodcock have been observed courting when weather conditions were far from ideal. On one occasion woodcock were observed "singing" where there was a foot of very hard-crusted snow on the ground, and the temperature was 15° F. They are most active, however, when temperatures are above freezing, and when winds are nearly calm. The woodcock breeding season in Pennsylvania extends from the first week in March to the third week in May. Courtship activity tapers off rapidly after the second week in May, and activity nearly ceases by the first week of June.

The job of selecting the nesting site, preparing the nest, incubating the eggs, and care of the young is left to the female woodcock. The procedure of selecting the site, and preparing the nest is simply done by squatting down in the leaves or grass under a relatively small amount of overhead cover. Woodcock have been found nesting in old fields with no overhead woody plant cover, and in young mixed hardwood stands up to 50 feet tall. The average height of nesting cover, however, is 12 feet. A wide variety of vegetative types and sites are used as nesting areas, but a preference is shown for an edge of small trees or shrubs. Hawthorn, crab apple, alder, gray dogwood, aspen, elm and maple are the most frequently occurring plant species found at the nesting

sites. And while they do nest in bottomlands adjacent to small streams, they prefer to nest on hillsides near the streams.

Woodcock ordinarily lay 4 eggs to complete a clutch. Clutches of 5 eggs are rare, but it is not uncommon to find nests containing 2 or 3 eggs. In most instances the small clutches are found late in the season and indicate re-nesting. Woodcocks do not produce more than one brood of young per season, but do re-nest if their first nest is unsuccessful. During the course of the study sufficient observations were made on 54 nests to reveal an average clutch size of 3.66 eggs.

Previous investigations have found that the length of the woodcock incubation period varied from 19 to 22 days. The writer was fortunate in having the opportunity to observe the exact incubation time for 2 nests. The details are as follows:

On April 9, 1954, at 9 a.m. a woodcock hen was flushed from a nest containing 3 eggs. Later that same day, 3 p.m., the nest held 4 eggs. Twenty-one days later, April 30, the eggs hatched. On another occasion, April 9, 1955, a nest containing one egg was located. Not until April 11, when 4 eggs were in the nest did the hen begin to spend full time at incubating. As in the previous case, 21 days later 4 woodcock chicks hatched.

Pennsylvania woodcock enjoy a rather long nesting season. Although hatching has been observed from as early as April 5 to as late as June 14 the peak of the hatching season is the last week in April. Approximately 40 per cent of the woodcock nests hatch during the last week in April, and 70 per cent hatch from the third week in April through the first week of May. Back-dating the earliest hatching date it can be calculated that incubation of that particular nest began on March 15 and that egg laying started on March 11. From this and other observations of early nesting it is easy to understand why some woodcock are found nesting in the snow.

A high percentage of nesting success is especially important to a bird of such a low individual reproductive capacity as the woodcock. It was encouraging to learn that woodcock do experience a relatively high rate of success in nesting. Approximately 60 per cent of the nests under observation were successful (considered successful if one or more eggs hatched), when

SPOTTED BUFFY BROWN EGGS against brown leaves are almost impossible to see from a short distance. A sitting hen is even more difficult to see unless the nest has been discovered previously.

losses from all causes were considered. If losses from unnatural causes, such as dogs, cats, and man, are discounted the success rate would be close to 70 per cent. Compare this to the 33 per cent nesting success of quail, as recorded by Latham and Studholme (1952) when losses from all causes were regarded.

Woodcock nest losses can be attributed to several causes. Predation and desertion, due to interference, are the broad reasons which can be listed. To be more specific, however, the following breakdown was recorded for 30 unsuccessful nests: (1) Predation by: mammals (raccoon, skunk, and house cat)—10, birds (hawk killed nesting hen)—1, snakes (black snake)—2, (2) Desertion due to: interference by man and/or dogs—7, retarded development of eggs—6, and (3) Unknown causes—4. It was also interesting to note that 53 per cent of the losses occurred during the early stages of incubation, 17 per cent during the middle stage, and 30 per cent during the late stage.

Brood Size

In the course of the woodcock nesting studies observations were also made on broods of chicks. It was found that the average brood size for 38 broods was 3.03 chicks. This would indicate a nest loss of 17 per cent since the average clutch size was computed as 3.66 eggs. Add to this a probable loss of 5 per cent for juvenal mortality and it is easily ascertained that the average reproductive rate is 2.88 young for each hen which is successful in bringing off a brood.

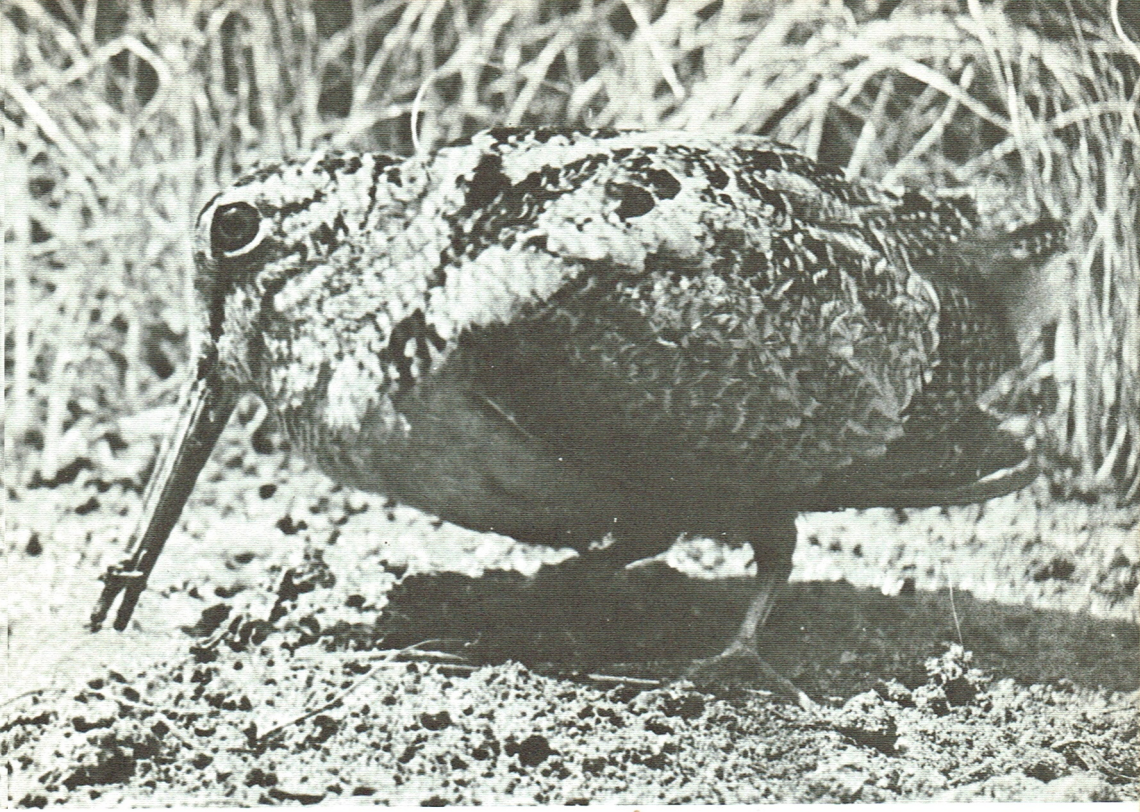
WOODCOCK BROODS average 3.03 chicks per successful hen. Youngsters are able to leave nests as soon as they are dry. *PGC Photo by the Author*

Adult Woodcock

Woodcock are practically full grown when they are about a month old. After this it is impossible to differentiate between age and sex without close examination and know how. (See sketch on sexing and aging on back cover.) The plumage, basically brown and tan with patterns of black, blue, gray and white, is alike in both sexes. Although structurally resembling other members of the shorebird family, woodcock anatomy is unique in several ways. Its long bill, for example (average 2¾"), with a flexible upper mandible, is especially suitable for the woodcock's manner of acquiring food. And eyes set high on the head provide for a wide range of vision. The female woodcock is slightly larger and heavier than the male. The average weight of 87 males examined was 5.6 ounces and of 79 females 6.2 ounces (during October and November). The weight of both male and female increase as the season progresses.

In conclusion, it can be pointed out that, due to its low reproductive capacity, and other restrictive features to be discussed later, woodcock need to be given special consideration in management.

How well these special considerations will be incorporated with other demands on our renewable resources will depend to a large extent on the wishes of the public. The pattern of land use will, in the long run, be the limiting factor.



EARTHWORMS CONSTITUTE the major portion of the woodcock's diet. Investigations have shown that from 50-75 per cent of the bird's bill-of-fare is earthworms.

FOOD AND FEEDING BEHAVIOR

AN IMPORTANT feature in the life of any species is its food requirements. With some species it is even more important than with others. The more specific the nature of the required food the more serious the problem. And so it is with the woodcock.

It is a well-known fact that earthworms constitute the major portion of the woodcock diet. Several investigators have reported this fact (Sperry, 1940; Mendall, 1943; and Miller, 1957). These investigators found that 50 to 70 per cent of the woodcock's diet consisted of earthworms. Insects, which included beetles, caterpillars, and grasshoppers; and seeds, such as sedges and blackberries, made up a smaller, though significant part of the bill-of-fare. It is suggested that most of the seeds were eaten in the process of feeding on the animal matter. Valuable as this information is, it now behooves us to learn something about the various food items and their specific relationship to woodcock and woodcock habits.

To shed some light on this subject limited studies were conducted in some good Pennsylvania woodcock areas and on a number of captive woodcock. A report of the findings from the habitat investigations will be presented at another time. However, it was obvious that when and where earthworms were scarce or unavailable, woodcock were also few or absent.

The studies of captive woodcock revealed a number of very interesting

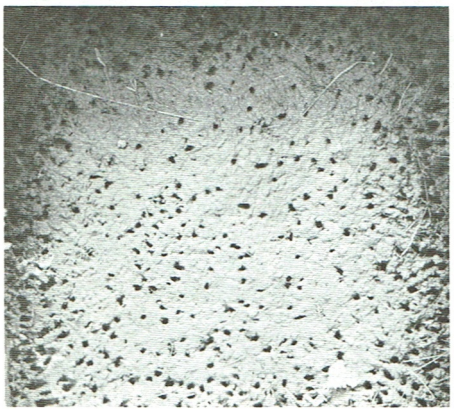
and useful facts. Not only was the amount of food needed to sustain woodcock determined, but also the variety of unusual food which they would eat was disclosed. In addition, an opportunity was thus provided to observe the manner in which woodcock found and ate their food and the preference they showed for feeding in several types of soil. Such information was indeed helpful in verifying observations made in the woodcocks' natural environment.

Variety of Foods Eaten

After learning the woodcock would eat readily during daylight hours, making it easy to observe feeding activity, a number of different food items were presented to the captive birds. These items included night crawlers, garden worms, meal worms, fly larvae, small grasshoppers, and slivers of venison, fish and luncheon meat. A tabulation of the quantity of these foods given as well as the quantity consumed by two woodcock is listed below. The food consumed amounted to approximately 2 ounces per bird per day.

In terms of numbers this averages out to 5 night crawlers and 47 garden worms per bird per day.

PROBING TRAYS such as this were used in the study to find out the woodcock's preference for various types of soils. The small holes are the marks made by the bird as he probed for earthworms.



Food of Two Woodcock During Five Days of Captivity

Kind of Food Given	No. of Food Items Given	Taken
Night Crawlers	65	46
Garden Worms	520	470
Fly Larvae	180	150
Meal Worms	125	110
Grasshoppers	30	18
Deer Liver	17	13
Deer Steak	10	6
Luncheon Meat	10	10
Fish Fillet	5	0

A brief explanation of the woodcock's reaction to the various food items is necessary at this point. Live earthworms were always the preferred food. Sometimes the larger ones were taken first, sometimes the smaller. Dead earthworms were rarely ingested. Fly larvae and meal worms were readily accepted when earthworms were not available. Grasshoppers would not be eaten unless the wings were removed; although occasionally they made attempts to eat the winged version. The slivers of meat were seldom taken unless they were placed in a shallow (⅛-inch) pool of water. Apparently the water kept the slivers soft and worm-like. The slivers of fish were never eaten or picked up by the woodcock.

Quantity of Earthworms Eaten

The quantity of food that woodcock can eat has often been recorded in literature. Some have noted that woodcock eat their own weight in food daily. Others have stated that woodcock can eat twice their weight in 24 hours. Be that as it may, this writer found that woodcock can be kept alive and in good health on approximately one-half their weight in food daily.

During 12 days of captivity two woodcock were offered about 5 pounds of earthworms. Sixty per cent, or about 3 pounds were consumed. This averaged approximately 2 ounces per bird per day. The range in the amount of

EARTHWORMS BEWARE, here comes Mr. Timberdoodle. This series of pictures taken by the author shows the interesting method in which the woodcock finds food. When earthworms or other food is not readily available on soil surface, with that long, pliable bill, he probes the earth until he hits an earthworm.

earthworms eaten daily was from ½ to 3½ ounces per bird. By the 12th day each of the birds had experienced a weight loss of 30 per cent. At this time they were released in the wild appearing none the worse for their experience (see Fgure 1).

On the other hand two additional woodcock were subjected to drastically reduced diets after five days on ample feed. Three days after being placed on the restricted diet both birds died. One had lost 40 per cent of its original weight and the other 42 per cent. It appears then, that woodcock normally lose weight in captivity and can withstand losses up to 30 per cent.

On the basis of the above data it is suggested that woodcock can be adequately nourished with a quantity of earthworms equal to one-half their own body weight daily. With a regular diet of about 3 ounces of earthworms daily there is every reason to believe that woodcock could live over long periods with little if any loss in weight or vigor.

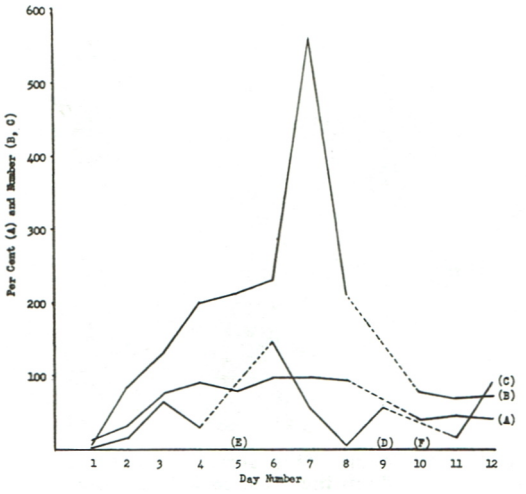
It is interesting, at this point, to note the probable cost of feeding woodcock in captivity. To the best of the writer's knowledge, the current wholesale price of earthworms is $1.60 per pound. At a feeding rate of 3 ounces of earthworms daily it would cost 30 cents per bird per day. It should be mentioned, in passing, that it may be possible to substitute a less expensive food, such as ground or sliced meat, spaghetti or macaroni, and thus reduce the cost.

Nutrient Composition of Earthworms

That earthworms compare in nutrition to a good grade of beef, liver or fish was proven by Dr. C. E. French at the Department of Animal Nutrition, Pennsylvania State University in 1957. An analysis of three species of earthworms showed that after all body fluid was removed by drying, the remaining matter contained a high percentage (53-64) of protein and sizable amounts of fat and energy (the earthworm contains 83 per cent moisture and 17 per cent dry matter). They were low in carbohydrate, however, and contained large amounts of ash. The high ash content is partially due to their eating particles of soil which could not be scoured from the worms prior to analysis.

Manner of Eating Earthworms

To describe the actual feeding behavior of woodcock a direct copy from the writer's field notes will suffice. "August 4, 1957: 4 P.M. After placing 150 garden worms in and on the soil



Daily feeding behavior of two captive woodcock.

(A) - Per cent of available earthworms eaten.
(B) - Average number of probe holes per box in soil containing earthworms.
(C) - Average number of probe holes per box in soil containing NO earthworms.
D) - Day on which NONE of the boxes contained earthworms.
E,F)-Days on which ALL of the boxes contained earthworms.

Figure 1.

of the feeding chamber, a woodcock was placed inside. Within 3 minutes the woodcock began feeding. In the next 5 minutes the bird ate 22 of the worms (.7 ounce); seeming to eat until it could hold no more. Indeed, the last few worms dangled from the corners of its mouth until space was somehow made to allow him to eat more. In the process of eating it selected a worm from the surface or extracted one from within the soil (soil depth 1 to 1½ inches), straightened the worm out in its bill, using a foot if necessary, and quickly swallowed. Occasionally a worm was eaten in a doubled-up position. The worms were reached for, or probed for, with a slightly opened bill. Often the worm was dropped to permit a better position for swallowing; namely, end first. A number of times the woodcock hammered its bill on the bottom of the box, where there was little or no soil, as if to remove excess soil which accumulated on its bill. While swallowing the woodcock frequently moved its body up and down as if it were necessary to aid its eating. After stuffing itself, the bird walked about stretching, ruffling its feathers, and again moving its body up and down in a peculiar fashion. Soon after it closed its eyes as if in sleep."

Preference for Soils

Another phase of the study dealt with the woodcock's ability to detect worms under varied soil conditions and preference for the earth he probed.

In order to do this, a series of boxes were embedded in the soil within the enclosure. Two boxes were filled with sand, two with loam, and two with clay. Precautions were taken to prohibit the escape of the earthworms and to insure easy accessibility of the worms to the woodcock. Detailed records were kept daily on the amount of earthworms presented and eaten, and the number of probe holes for each box.

It has long been suspected that woodcock obtain most of their food from soils not excessively sandy. Areas along stream bottoms which are suitable as woodcock feeding areas are sometimes destroyed by large deposits of sand washed up during spring floods. When this happens the earthworm supply is drastically reduced, and in turn, woodcock do not frequent the site.

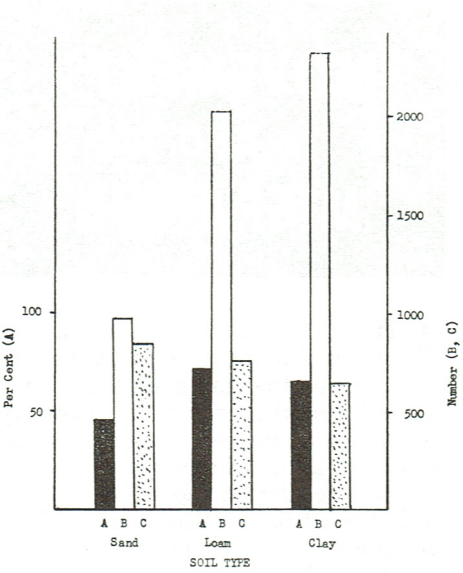
Inherently then, woodcock may refrain from attempting to feed in such soils. This was found to be somewhat true in the feeding tests with captive birds. Whereas only 46 per cent of the earthworms placed in sand were utilized by woodcock 64 and 71 per cent of those placed in clay and loam, respectively, were utilized. Probing was heaviest in clay, next in loam, and least in sand when the soils contained earthworms, but the reverse was true, though to a lesser extent, when the soils contained no earthworms. It was also noted that woodcock often refused to eat the worms they extracted from the sand. This data is graphically illustrated in Figure 2.

Ability to Detect Earthworms in Soil

Evidence accrued in the study showed that woodcock may, to a cer-

tain extent, detect earthworms in soil. The graph shows that the soils containing earthworms were probed more often than those which did not. This difference occurred even when the boxes were reversed. However, the data indicated that the process of trial and error was the normal procedure. In other words, the woodcock probed about until it found worms; then it would concentrate where finding was best.

From this phase of the woodcock management study we have acquired a better understanding of still another important part of the life history of the woodcock. We have found what foods woodcock will eat, how much they require, and how they go about feeding. The implications to management are quite obvious. Subsequent articles will reveal how these findings support observations made in the field, and how important various related factors are in the life of the timberdoodle.



Captive Woodcock Feeding Behavior on Three Types of Soil.

A - Per cent of available earthworms eaten.
B - Number of probe holes in soil containing earthworms.
C - Number of probe holes in soil containing NO earthworms.

Figure 2.

MOVEMENTS AND MIGRATION

THE extent to which an animal moves about is of considerable importance to the game manager. For example, in the case of a migratory bird such as the woodcock, it is important to know whether or not we are shooting resident or nonresident birds and at what time in the season one or the other is most likely to be present. It is helpful to know if resident woodcock require the same habitat during spring, summer and fall months. To find some answers to the above questions a number of woodcock have been captured and banded by research personnel of the Pennsylvania Game Commission. The results of these studies are given below:

Movements

From 1939 to 1960 a total of 239 woodcock have been banded in Pennsylvania; 204 of which were marked during the recent investigations (1952-60). Of this number 48 have been recovered. Twenty-seven of the recoveries were made by trapping and 21 resulted from shooting. Six of the retrapped birds were captured twice and three of the woodcock which were shot were taken outside the state. During this same period five woodcock banded outside of the state were bagged in Pennsylvania.

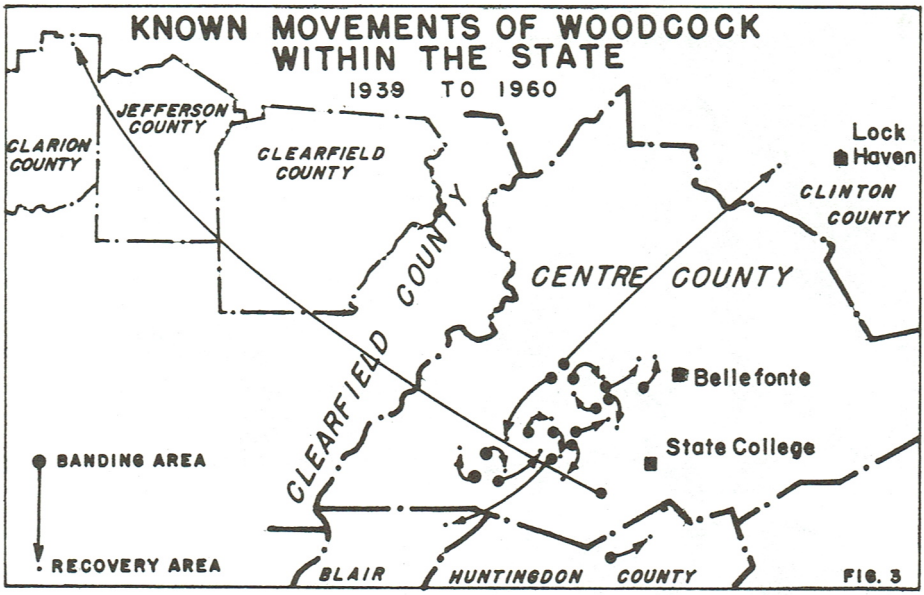
The distance traveled by these woodcock is indeed interesting. It's amazing how little they travel when not migrating. Of the 45 recoveries made within the state 24 traveled less than a few hundred yards, 12 went approximately one mile, 3 went 2 miles, 2 moved five miles and one each traveled 7, 8, 35 and 80 miles. All but two of the recoveries were made during the same year. An illustrated account of these movements is presented in Figures 1 and 2.

Field observations and banding records also revealed that the number of woodcock found in a particular area, or covert, can vary with the seasons and with changing weather. Some areas capable of holding a population of breeding woodcock in the spring do not support them during the droughty parts of summer and fall. Other areas are capable of sustaining woodcock the year around, except, of course, during the winter months. It would certainly be to our advantage if more was known about their movements and why they occur.

Migration

It is rather common knowledge that woodcock are migratory birds. On the other hand relatively little is known about the details of their migrations. Many have speculated on the time and direction of migrations, on the composition of sex and age of migrant flocks, and on the manner of distinguishing between migrating woodcock and resident woodcock not yet migrating. Information on these matters is being gathered by several investiga-

ONE OF THE METHODS used to trap woodcock for banding. This is a modified funnel type trap also used to capture other species.



tors throughout the range of this game bird. To this fund of knowledge the following data, relative to Pennsylvania conditions, has been collected:

Woodcock return to Pennsylvania from their wintering grounds or early as the last week in February. Even in northern Pennsylvania woodcock have been observed during the first few days in March. The bulk of the woodcock, however, do not cross our borders until the last two weeks in March. Migration to and through Pennsylvania is complete by the second week in April.

Of more interest, especially to the bird hunter, is the time that woodcock return to their winter range. The expression "It's later than you think" may well apply here. In recent years, at least, the big push has occurred during the last week in October or the first week of November.

The belief that local woodcock move out before "flights" of more northern birds across the state has been disproven. Banding returns show that resident woodcock are bagged throughout the hunting season, and at the same time that migration is in progress. Most of these banded resident woodcock were bagged within a few hundred yards of the point of capture.

Occasionally native birds, especially in the northern tier counties, may move to new locations (relatively short flights) earlier in October. Hunt-

WEIGHTS AND MEASUREMENTS are taken on all birds trapped and banded. Here the author collects data for use in his study of the woodcock in the Keystone State.

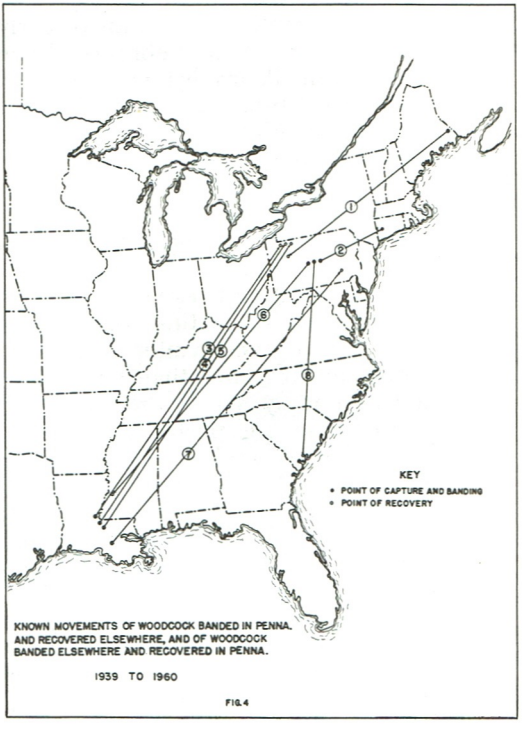
WOODCOCK BANDING is the chief source of information used to acquire knowledge about the birds' movement and migration. Here author Steve Liscinsky carefully places a numbered band on a youngster.

ers finding the woodcock, which sometimes occur in loose flocks, assume that the "big flights" are on. Later, these groupings of local birds, which may be preparing to migrate, are mistaken for nonresident migrants again. And reasonably so—for there is no known way of telling a "flight" woodcock from a resident woodcock by either the plumage, weight, or the manner of flying. It is more safe to differentiate between migrating and local groups by an intimate knowledge of the number of woodcock using particular coverts throughout the season. A sudden influx (15 more birds) in a specific area a day or two after there were none will tell you that a flight group moved in but it will not tell you where they came from. In addition migrating woodcock often stop to rest in localities not frequented by local birds.

Although it is not uncommon to find groups of migrating woodcock (spring and fall) numbering 20 to 30 birds, it is rare that one observes groups numbering over 100. In this connection the largest group of mi-

KNOWN MOVEMENTS OF WOODCOCK BANDED IN PENNSYLVANIA AND RECOVERED ELSEWHERE, AND OF WOODCOCK BANDED ELSEWHERE AND RECOVERED IN PENNSYLVANIA

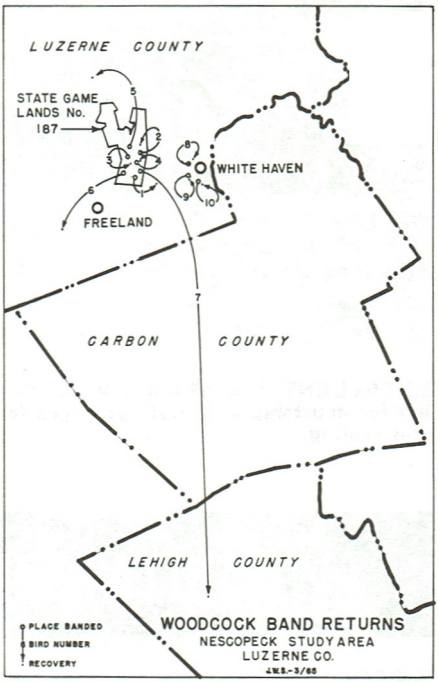
Number	*Date of*		*Time Lapse*	
	Banding	*Recovery*	*Years*	*Days*
1	5/10/41	10/24/41		167
2	4/8/40	11/5/40		212
3	1/2/54	10/30/54		302
4	2/3/41	10/21/41		264
5	1/3/52	10/18/52		298
6	5/8/39	12/27/40	1	236
7	12/28/53	11/11/59	5	318
8	4/29/53	2/11/54		300



grating woodcock observed in recent years occurred on November 7, 1955, in northwestern Pennsylvania when approximately 200 woodcock were encountered in one location. About mid-November woodcock become increasingly scarce, and by November 24-25 the fall migration is complete.

WOODCOCK BANDED IN AND NEAR NESCOPECK STUDY AREA
(SGL 187—LUZERNE CO.)

Number	*Date Banded*	*Date Recovered*	*Distance Traveled*
1	4/29/61	11/2/61	2½ miles
2	5/2/61	11/8/61	200 yards
3	5/13/61	10/25/61	300 yards
4	5/14/62	10/13/62	100 yards
5	4/24/63	10/12/63	5 miles
6	4/24/63	10/18/63	1 mile
7	4/26/63	11/5/63	30 miles
8	5/3/63	10/10/64	100 yards
9	5/5/63	10/12/63	100 yards
10	5/13/63	10/17/63	200 yards



PGC Photo

EXCELLENT ALL SEASON WOODCOCK HABITAT in Pennsylvania showing opening for courtship and mating; edges for nesting; and streamside contact for feeding and resting.

HABITAT REQUIREMENTS

WOODCOCK have very specific food and cover requirements; and, as a result, population numbers are largely governed by the quantity and quality of available habitat. The following discussion concerns food and cover conditions needed to sustain and perpetuate woodcock populations.

Basic Needs

Broadly speaking, woodcock require an environment that provides breeding grounds, nesting sites, feeding areas, and resting places. These necessities of life are usually found in Pennsylvania areas containing grassy or weedy openings, shrub or small tree thickets, and soil harboring a rather constant supply of woodcock food. Areas recently retired from cultivation, partially drained swamplands, and recently burned or cut-over forests commonly provide this type of environment.

Courtship and mating take place in clearings that are devoid of woody vegetation. Breeding grounds of about a quarter acre in size appear adequate. Sites half this size are sometimes used, especially if surrounded by low brush or shrubby growth.

Nesting sites are most frequently found in the edge of shrub thickets not far from the mating fields. Occasionally, however, briar patches, sapling groves, and young conifer stands are used. Resting or loafing sometimes occurs in these and similar locations.

An adequate food supply is the most important single habitat requirement. This, of course, is due to the specific nature of the woodcock's diet, which is mostly earthworms. The best feeding areas are found in shrub patches adjacent to streams, small watercourses and springs.

Coverts where woodcock rest and spend their inactive time are usually found on higher, drier ground usually away from feeding areas. Low woody vegetation meets this type of need.

Whenever one or more of the above requirements are missing, woodcock frequently abandon an area and move to a more favorable location. On occasion, changing weather conditions can influence the supply of available food and force the woodcock to move. On

the other hand, the better locations provide such an attractive environment that they sustain woodcock numbers throughout their stay in Pennsylvania.

A closer look at the vegetational and soil characteristics of woodcock habitat should prove interesting.

Cover Types

One important aspect of a habitat study is to note the composition of the flora. Composition, as used here, refers to the various plant species occurring within woodcock habitat. During the investigation an intensive summer and fall study of habitat was made in central Pennsylvania.

Although a wide variety of vegetation was recorded, relatively few plant species occurred more often than 15 per cent of the time. In the shrubby vegetation, the occurrence of common alder was 56 per cent, crab apple 42 per cent, and hawthorn, silky dogwood and blackberry 19 per cent each. Such species as willow, red maple, gray dogwood, elm, blue beech and aspen appeared commonly, but less frequently than 15 per cent. In the herbaceous ground cover, grasses, sedges and goldenrod occurred 92, 65, and 42 per cent, respectively. Jewelweed, sensitive fern, violet, yarrow and asters were the next most common.

A state-wide survey revealed that regional differences do exist in the vegetative composition of various woodcock cover types. For instance, it was found that alder was the predominant cover type in central and northeastern Pennsylvania, but the aspen type predominated in the northwestern part of the state. These differences may be seen in the accompanying illustration. On a state-wide basis alder constitutes the most important cover type. Though secondary in importance, aspen and hawthorn-crab apple thickets play a very important role.

Perhaps as important as vegetative composition is the density of the stand and the distribution of the coverts. This applies not only to the shrub layer but also to the ground cover. It was found that woodcock prefer to use the edge rather than the interior of large even-aged thickets. Greater year around woodcock use was also noted when the various covert types were scattered over different parts of the terrain, i.e., some along the stream bottom, and some on the adjacent slopes. Under such circumstances woodcock are able to take advantage of changing site conditions brought on by seasonal weather changes. It was also observed that woodcock preferred areas where 25 per cent of the ground was covered with vegetation. Complete absence of ground cover indicated a scarcity of earthworms, while heavy ground cover appeared to hinder the process of acquiring food.

Soil Properties

During the early stages of the study it became obvious that woodcock habitat requirements encompassed more than vegetative composition alone. It was later found that unless the soil beneath or near the coverts contained a readily available supply of food (preferably earthworms), the site was

NESTING SITES are most frequently found in the edge of shrub thickets not far from the mating fields.

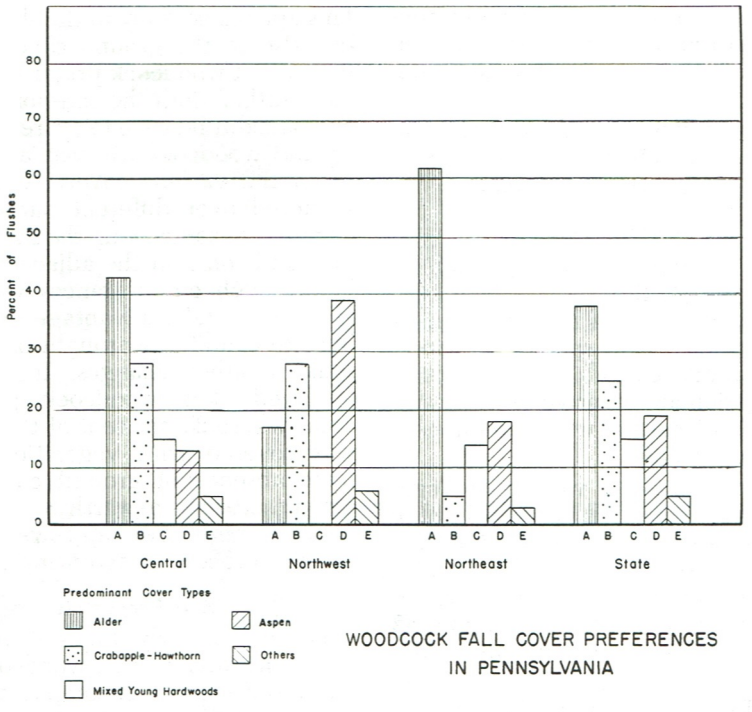


FIG. 5

seldom used. The supply of earthworms is, in turn, affected by such soil properties as texture, moisture, temperature, and organic content. Excessive amounts of, or lack of, any of these properties have a detrimental effect on the supply of earthworms. Not only do differences exist between sites at the same time, but also on the same sites between seasons.

While many interacting factors are at work at a given time to counteract unfavorable conditions for earthworms, certain features appear to be more important than others. Soil moisture appears to play the most important role in this respect. Several investigators have pointed out that lack of or excessive amounts of moisture in the soil are harmful to earthworms. Soil texture reflects the ability of a soil to retain moisture, and, as such, influences earthworm production. It was found, for instance, that very sandy soil without the compensating elements of moisture and organic matter harbors few worms. Conversely, earthworm production was higher in sandy loam and loam textured soils than in clay and silt soils.

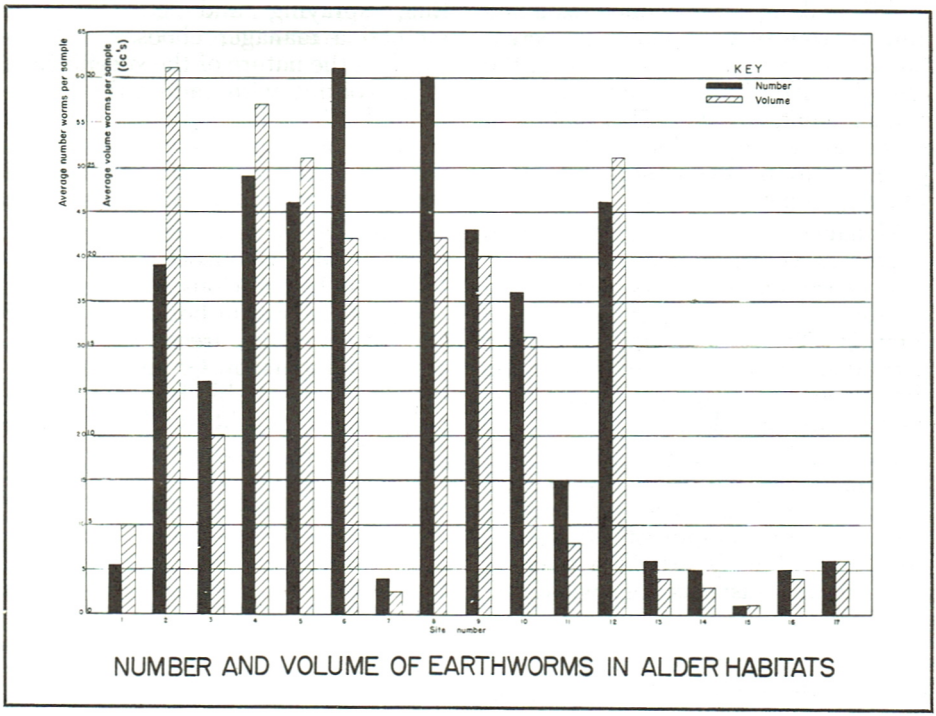
In an effort to determine differences in the availability of earthworms, measurements were taken in several different cover types. Simultaneous measurements were made in a cornfield, an abandoned field, an alder thicket and a young pole-stage forest. Of these adjacent sites, the alder thicket proved to be the most productive. When compared to the poorest or abandoned field site, alder thickets produced five times the number of worms and ten times the volume. In another experiment, 18 alder stands,

PGC Photo by George H. Harrison

AN EXPERIMENTAL WOODCOCK MANAGEMENT area in Huntingdon County. Large trees are removed to encourage shrub growth. A woodcock used this particular spot as a nesting site.

on different sites but of about the same age structure, were examined for both earthworm supply and woodcock utilization. The stands containing the fewest number of earthworms received the least amount of usage by woodcock. The accompanying graph illustrates the variability of earthworms in alder habitats. It was further found that poorest earthworm production occurred in alder sites that were either excessively moist or strongly acidic.

In conclusion it should be mentioned that the life of a woodcock covert in Pennsylvania is relatively short, at best, about 20 to 25 years. And unlike some woodcock habitats in more northern states and Canada, our coverts seldom regenerate themselves on the same site. Instead they change into a forest type through the natural process of plant succession. The development of management practices that can be used to maintain coverts in woodcock production over extended periods of time is one of the objectives of this study.



NUMBER AND VOLUME OF EARTHWORMS IN ALDER HABITATS

Figure 6

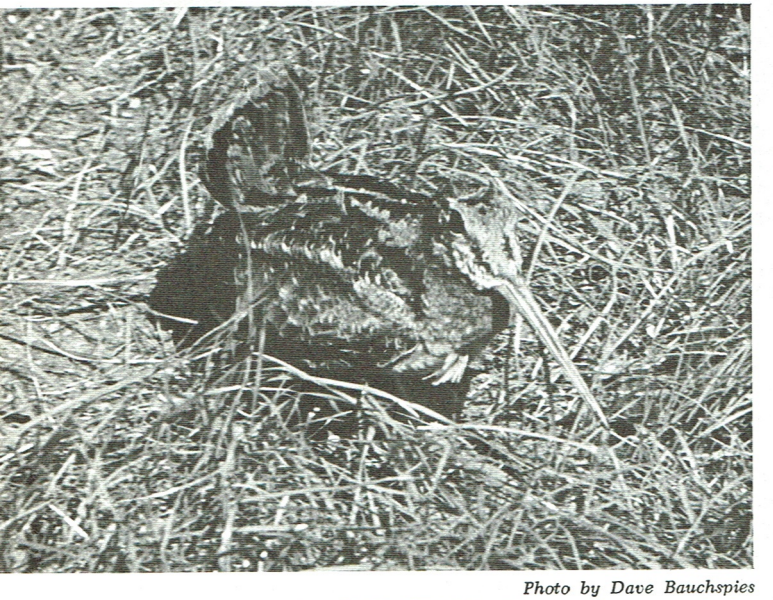


Photo by Dave Bauchspies

THE OBJECT OF THE STUDY, the woodcock and the management of its habitat have been investigated by the author over a 10-year period. This publication reveals some of his findings.

HABITAT MANAGEMENT

"GAME management is the art of making land produce sustained annual crops of wild game for recreational use." So said Aldo Leopold, the often heralded father of modern game management, in 1932. This definition is certainly applicable today, and promises to be even more fitting in years to come.

Management, in itself, implies some degree of control. In game management recent emphasis has been placed on the control of environment and hunting. The central thesis of this particular study was to investigate these factors in relation to one species; namely, the woodcock.

The foregoing chapter dealt with the habitat requirements of woodcock. This article deals with methods of controlling or manipulating this habitat. The following article will cover the hunting aspects of woodcock management.

Basic Procedures

The basic methods of manipulating woodcock habitat are planting, cutting, spraying and grazing. The method a manager chooses will depend on the nature of the specific area he is working with and on the results desired. The following is a discussion of the manner in which these techniques can be used to advantage in manipulating woodcock coverts.

Planting. Many areas having little, or no suitable woodcock cover can be improved by judicious planting. This is especially true in bottomlands near streams, and in areas adjacent to ponds and marshes. Quite often these locations are suitable from the standpoint of soil fertility and earthworm production but lack adequate cover. Planting of shrubs or small trees would do much to make the site more attractive to woodcock.

Numerous shrubs, such as alder, gray and silky dogwood, black haw and dentate viburnum, and hawthorns can be used for this purpose. However, alder was found to be, by far, the most easily propagated and

the most beneficial. Techniques for planting alder and other species are described later.

It is not necessary to plant extensive areas or to follow a set pattern of arrangement. Row and group plantings of several hundred plants, separated by about fifty yards, will serve as a nucleus from which the thickets will spread.

Cutting. Cutting is certainly one of the best methods of rejuvenating and maintaining woodcock habitat. Three types of cutting; namely, clearcutting, release cutting and thinning were found to be useful.

On one of the study areas, clearcutting, or the complete severance of all woody stems, was used to create mating fields, and to regenerate alder and aspen. Release cuttings were generally employed where coverts were being overtaken by large trees. Removal of these large trees (over 4 inches in diameter) allowed the remnant stock of shrubs and small tree species to re-dominate the site, thus making it more desirable for woodcock. Elm, red maple, white ash, and black cherry are the most common invading large tree species. Thinning was used in dense coverts to allow more sunlight to reach the soil surface, and thus promote the growth of herbaceous vegetation and earthworms. Although this latter practice may have limited use it was found helpful in dense stands of crab apple and hawthorn.

Spraying. The use of chemical agents in controlling vegetation has received much attention in recent years. Their usefulness in manipulating woodcock coverts was investigated during this particular study.

Of the three methods of applying herbicides; i.e., on the foliage, on the basal portion of the stem, and on the stump, only one was found to be of real practical value. The technique of spraying freshly cut stumps with a solution of 2,4,5-T and fuel oil was very effective in retarding sprouting. This practice was especially useful in establishing clearings and controlling regrowth of felled trees in release cuttings. Thinning of dense stands and killing undesirable woody stems by basal application of the same material showed some possibilities for special cases.

Grazing. Cattle grazing can have a beneficial or detrimental effect on woodcock habitat. It depends on the degree of grazing. These statements are based on limited observations and controlled studies.

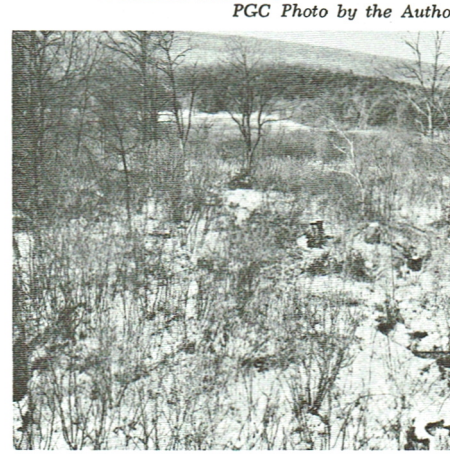
The data collected suggests that in order to improve and not destroy dense bottomland woodcock coverts a grazing intensity of not more than 30 days per acre be followed. A grazing day here meaning one head for one day. This would mean, for example, that a 12-acre patch could be grazed by 12 head for one month, or 6 head for 2 months, or 3 head for 3 months, etc., without hurting the area for woodcock, and in many instances improve it. In addition, it is suggested that the sites be left completely ungrazed one season out of every five.

Management of Specific Cover Types

Alder. Alder, as previously stated,

A CHEMICALLY TREATED area where tree stumps were killed allowed the growth of alder and gray dogwood for better woodcock habitat.

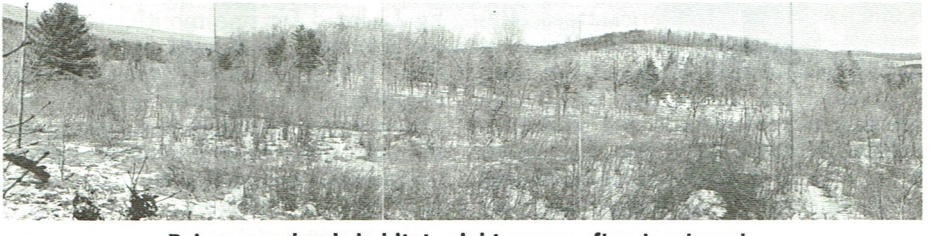
PGC Photo by the Author



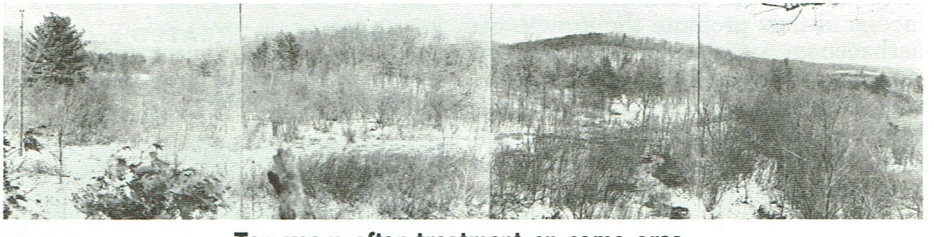
PGC Photos by the Author

Woodcock management area two years after cutting.

Same area four years after the managed cutting.



Prime woodcock habitat, eight years after treatment.



Ten years after treatment on same area.

was found to be by far the most important woodcock cover type in Pennsylvania. Techniques for creating and maintaining it were therefore given prime consideration.

Alder coverts can be established by planting seedlings and by direct sowing of seed. Two- and three-year-old seedling stock was found to be the best size for planting. Scalping of the sod prior to planting was helpful, but not absolutely essential. Greatest success in direct seeding was found when fall-collected seed was sown the following February and March. Disking of the sites prior to planting produced better results, but good catches were realized even when the seed was sown directly into the sod. Whether planting seedlings or sowing seed directly

—cool moist sites were found most suitable.

Mature and over-mature alder stands can best be rejuvenated by clearcutting during the dormant season. Treating the stumps of invading tall tree species with herbicide proved beneficial. One part 2,4,5-T, having an acid equivalent of 4 pounds per gallon, to 25 parts of fuel oil was one of several formulations which controlled sprouting. Care was taken not to spray the alder as it is rather easily killed by these herbicides.

Another good reason for managing alder which is often overlooked or misunderstood is the fact that alder has the ability to fix nitrogen, a very important element in plant growth. This feature should be of considerable interest to landowners who wish to maintain the fertility of idle acres and at the same time practice good game management.

Aspen. Aspen represents another very important type of woodcock habitat in Pennsylvania. It is also gaining importance as a source of pulpwood. Management of the species can, therefore, serve many uses.

Aspen is relatively intolerant to shade and must have practically full sunlight to reproduce and grow. It was found necessary, therefore, to clearcut aspen stands to achieve the best regeneration. If only a portion of the stand was removed and other species left uncut resprouting of aspen was less vigorous.

Another practice which proved helpful in reviving partially decadent stands was that of disking the soil prior to cutting. Of course this practice is feasible only where the stands are open enough and the terrain is suitable for the passage of mechanized equipment. Stump and basal spraying of undesirable species in the stands appears to be practical in some situations.

Hawthorn. The value of our native hawthorns as game habitat has been recognized by many observers. In numerous areas of the state they are an important component of woodcock cover. Considering the value of this species it is unfortunate that so little is known about its propagation and management.

AFTER LARGE TREES are removed, the stumps are chemically treated to eliminate resprouting. This allows desirable habitat to flourish.

The limited studies of hawthorn undertaken during this investigation leave much to be desired. Generally speaking, however, the findings indicated that some hawthorn stands could be improved by thinning, by selective cutting of inferior hawthorn species or by removing competing tall trees. Hawthorns are rather intolerant to shade, and do not survive in forests where the canopy is closed.

Gray Dogwood. Gray dogwood, like hawthorn, is one of our most valuable native shrubs. Its ability to grow on a wide variety of sites and to produce a good crop of highly preferred fruit is exceeded by few shrubs. Its intermediate tolerance to shade is an additional good feature.

Fair success has been realized from planting of seedling stock and some progress is being made in propagation by direct seeding. Removal of the sod prior to planting has proven beneficial, and better success was realized on the more fertile soils.

Gray dogwood thickets respond well to release cutting. Removal of overhead cover rejuvenated thickets while no removal resulted in continued loss of dogwood sprouts.

Other Types. There are a number of other important, but less frequently occurring plant species which are found in good woodcock habitat. Some of these are silky dogwood, willow, blue beech and gray birch. Often appearing as small pure groups within a covert they contribute much to the overall value of the natural environment of woodcock. It is suggested that these species can be maintained by cutting at about 20-year intervals.

There are some coverts which appear, outwardly, to be prime woodcock habitat but are seldom if ever used. It has been stated previously that floristic composition alone does not insure woodcock usage. Usually the problem here is one of improper soil conditions—too wet, too acid, too sandy or too anything—which seriously limits the production of woodcock food. These conditions are difficult to correct. Perhaps draining, clearcutting or bulldozing followed by planting would help in certain areas. All of these rehabilitation methods, however, appear to be impractical at present, but with growing demands on the use of lands they may become practical. The point to be made here is that it is much easier to maintain the good habitat already in existence than to let it degenerate while work is being done on problem areas. In many instances these problem areas are more suitable for other purposes in the first place. They should be treated for their greatest potential in reference to the total environment.

Habit Management Planning

Recommended Procedure. — In preparing a woodcock habitat management plan for a specific area, it is important to have a certain amount of background information.

First, the history of the area's habitat and woodcock population changes should be known. This information can often be obtained from hunters and conservation agency personnel who frequented the area in past years. Occasionally reports on a particular area can be found in the literature.

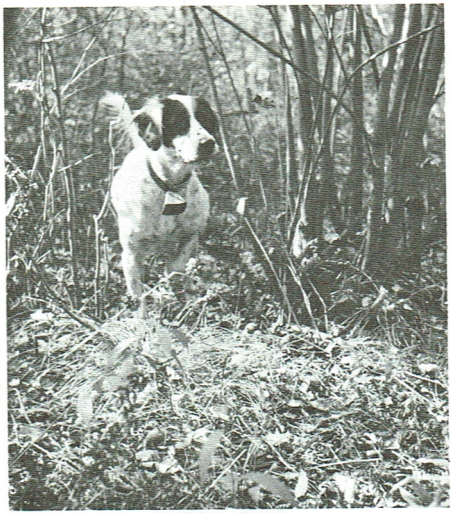
The next step is to determine the present status of the area. The current woodcock population and the amount of good habitat should be ascertained. A comparison of past and present conditions is of value in developing the full potential of the area.

Steps Can Be Taken

Once it is decided that habitat changes are the major reasons for the decline in woodcock steps can be taken to rectify matters. It must then be decided how much can and should be done. To select the approximate location of the various treatments a cover type map should be prepared.

With this background information a plan of action can be formulated. The vegetational characteristics of each type and the potential of various sites can be taken into consideration. Distribution of the necessary elements of woodcock habitat can thus be planned on a more intelligent basis. Approximate work areas and techniques of manipulating the various types can then be outlined in map and schedule form. Armed with this information the land manager should have little difficulty in carrying the plan to a successful conclusion.

HUNTING THE WOODCOCK



PGC Photo by Lincoln Lang

A GOOD BIRD DOG is one ticket to a successful woodcock hunt. Here an English setter holds a point on a woodcock in typical woodcock habitat.

DUE to its unique behavior and rather restricted habitat requirements, the woodcock can be easily subjected to overharvesting. In other words, excessive or ill-timed gunning pressure extending over several seasons can have a detrimental effect upon local breeding populations. Under certain circumstances hunting pressure plays a more important role than habitat in limiting woodcock numbers. As will be explained in the remainder of this article, the extent to which woodcock populations are influenced by hunting depends on the number of gunners, daily bag limit, timing of the hunting season and the size and accessibility of woodcock coverts.

Hunting Pressure

The fact that locally reared woodcock constitute an important part of the hunters' bag has been overlooked for many years. There is now reason to believe, however, that many of the so-called fall "flights" (groups of woodcock migrating across Pennsylvania from regions to the north) are, in reality, concentrations of locally produced birds. Banding records, discussed at length in a preceding chapter, serve to substantiate this fact. We do not know, unfortunately, the exact proportion of the total kill made up of locally produced woodcock.

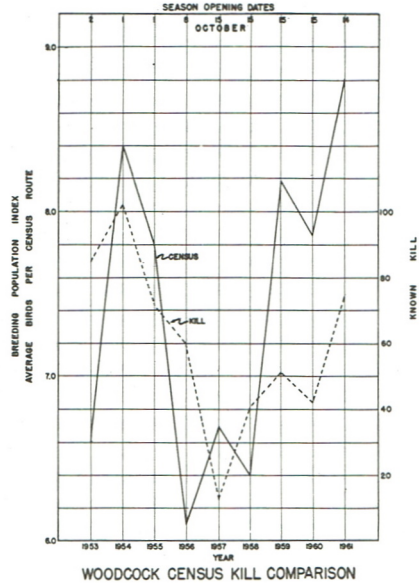
Indications are that here in Pennsylvania the hunting pressure in relation to the number of woodcock and the amount of woodcock habitat is greater than in most other states and provinces. On this basis, a season opening prior to migration causes excessive pressure on "resident" stock. In order to allow sufficient time for the migrants from the north to arrive and mingle with our local birds, the Pennsylvania woodcock season seldom opens before mid-October. In this manner greater protection is afforded locally produced birds and the return of adequate breeding stock is assured.

Studies have been made to show the effect of gunning pressure on woodcock. One of these investigations was made in central Pennsylvania. The study area, approximately one-half mile by 25 miles in size, contains about 3,000 acres of suitable woodcock habitat. Breeding population surveys and bag checks were conducted here from 1953 through 1961. Both the spring census and the hunting season kill indicated a reduction in numbers from 1953 to 1957. A reversal of this

trend was evident from 1957 to 1961. (See Fig. 1.) Note the change in opening dates from early October to mid-October, and the change in trend.

More recently (1956-1960) an experiment to determine the effect of gunning pressure on woodcock was conducted in Luzerne County. The area, a portion of which is State Game Lands No. 187, had a history of growing and persistent hunting pressure with a corresponding decline in the woodcock population. In 1956 hunters were requested to refrain from shooting woodcock on the study area. Personal contact and posters were used to achieve this end. The response to this request was indeed gratifying. No violations were detected. During the four-year period in which the area was closed the spring breeding population increased from 6 to 24 and the fall population increased from approximately 18 to 60 woodcock. In 1961 the area was reopened to hunting. Since that time the seasons opened in mid-October, instead of October first as was the former practice. To date (1964) the number of breeding woodcock and the number of woodcock bagged have remained stable at a rather high level.

IN PENNSYLVANIA, the hunting pressure in relation to the number of woodcock and the amount of woodcock habitat is greater than in most other states and provinces.

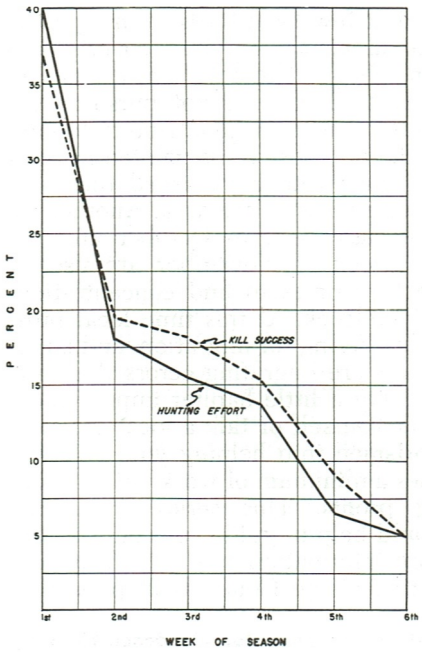


WOODCOCK CENSUS KILL COMPARISON
FOR BALD EAGLE STUDY AREA

Figure 7

Vulnerability to the Gun

That woodcock are quite vulnerable to the gun is seldom disputed. Recent state-wide studies show that approximately 40 per cent of the woodcock which were flushed were bagged. The reason for this high kill success stems to a large degree from the fact that, once found, woodcock are rather easily followed if not shot on the first rise. The bigger problem, on the part of the hunter, is to find the woodcock in the first place. It is interesting to note that this requires an average of approximately 1½ hours for each bird. Bringing it to bag requires an additional 1½ hours of hunting.

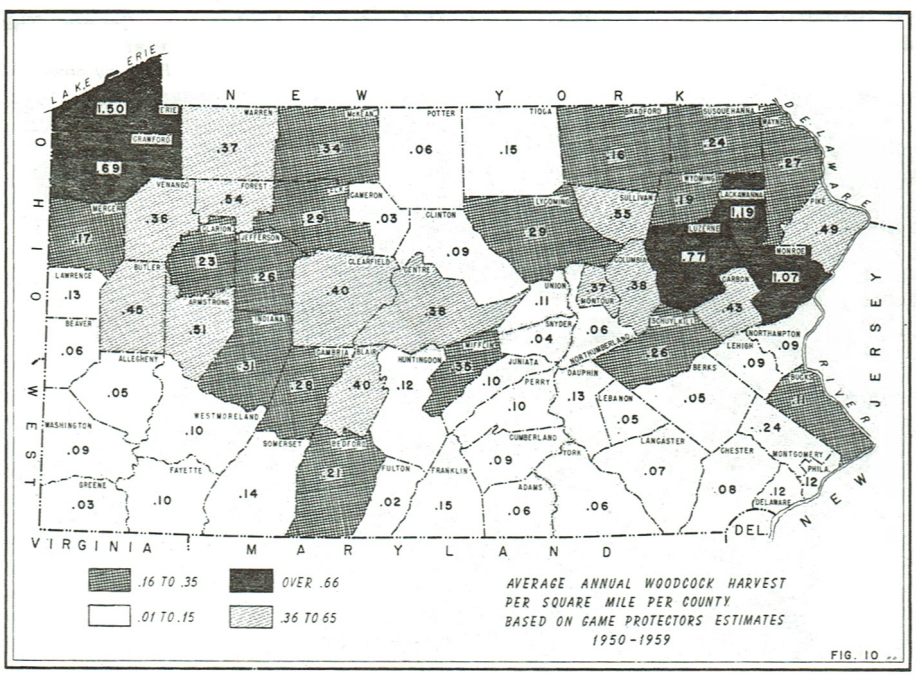


WEEKLY TREND IN WOODCOCK HUNTING EFFORT AND KILL SUCCESS, 1953–1956

Figure 8

Hunting Success

The relationship of hunting effort to kill success varies throughout the season. Based on an early October opening, success for the amount of hunting effort is less the first week of the season than during the second and third weeks. This is primarily due to the fact that there are more "once-a-season" woodcock hunters afield on opening days. Their inexperience is reflected in the fact that they do not know the whereabouts of the locally reared birds, nor do they realize that full-scale migration has not yet begun. Later in the season, usually the last week in October, local woodcock begin to congregate, and migration begins in earnest. Woodcock hunters knowing these habits and habitats reap greater returns for their efforts. This is graphically illustrated in Figure 8. It should be mentioned that the season opening dates for the 4 years this survey was conducted were in the first week of October.



Hunting Tips

Here are a few suggestions to help you get more enjoyment and sport from your trips afield.

1. Become more acquainted with woodcock habits and habitats. Observe them throughout the seasons—spring through fall. If you haven't observed woodcock courtship behavior there is a treat in store. Ask anyone familiar with this activity to show you. Such observations can give you an index of woodcock numbers in your favorite areas. Dusk flights, without the typical courtship displays, are not uncommon during summer months. These twilight flights, plus trips afield during dog training season will enable you to keep track of local populations. Except during droughty seasons and in areas readily affected by dry spells woodcock seldom change their habitats. Keep in mind the basic habitat requirements mentioned earlier.

2. Regulate your shooting to coincide with the number of woodcock in a particular covert. This is difficult, but remember—you may be shooting the last few local birds from a particular area. Know your coverts and don't begin shooting until you are fairly sure you are not pursuing the remnant stock. A good rule to follow: shoot only those birds pointed by your dog until you are satisfied there are enough birds in the area. Another tip—the last week in October and the first week of November are usually the best times to find concentrations of woodcock. At this time local birds are gathering for migration, and larger groups are migrating across the state.

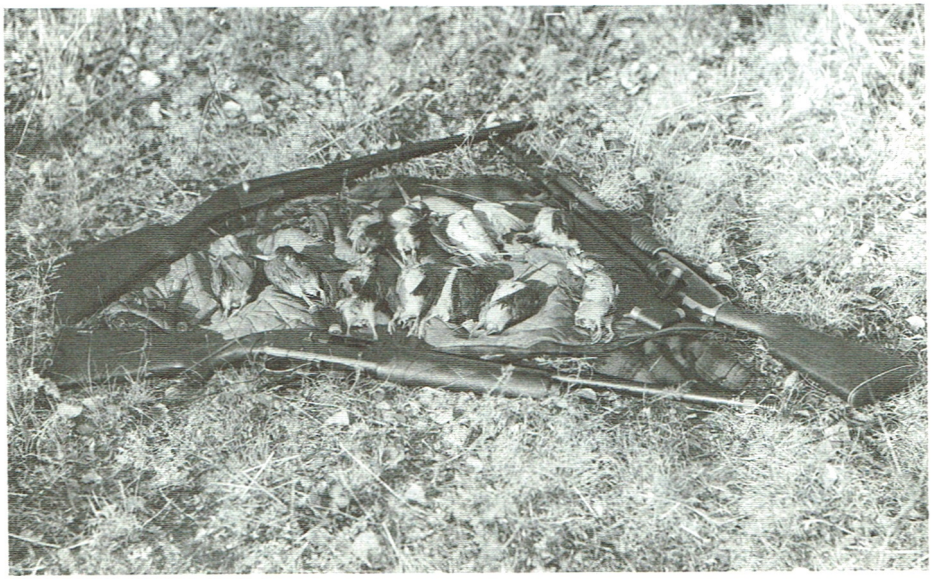
3. Try a little habitat improvement work yourself or talk a local group of sportsmen into helping you. In many cases a minimum of work will produce big profits. This series of articles should help to guide your efforts. And more information can be had by contacting Game Commission personnel.

Future Prospects for Woodcock Hunting

The question of future prospects of woodcock hunting is often asked. At present the pattern of land use in Pennsylvania is toward larger but

AN OPENING DAY bag for three woodcock hunters in Lackawanna County. This photograph was taken on October 12, 1963, on State Game Lands in that county.

PGC Photo by Steve Kish



fewer farms, toward increasing pasturelands, and toward pole-stage and saw log stage forests. This trend, generally speaking, indicates that we are losing more woodcock habitat than we are gaining. In the face of a growing human population and more intensive land use, it behooves us to put more emphasis on the management of our present coverts.

This can and is being done on several State Game Lands. These practices should be extended. In addition, seasons and bag limits are being adjusted to maintain maximum benefits. Population inventories are conducted annually. The Fish and Wildlife Service has recently stepped up its program of woodcock research and management.

Progress is surely being made and there is little reason to doubt that we cannot perpetuate the woodcock and the fine sport it provides for future generations of hunters.

THE BIG PROBLEM in woodcock hunting is not missing them after the flush, but to be able to find them in the first place.

Acknowledgments

This project was conducted under the Federal Aid to Wildlife Restoration Act of 1937 and designated as Pittman-Robertson Project 50 R (Woodcock Management Study). It was supervised by the U. S. Fish and Wildlife Service and the Pennsylvania Game Commission. Direct supervision was given by the Chiefs of the Division of Research, Pennsylvania Game Commission. These were Dr. Roger W. Latham, Glenn L. Bowers and Harvey A. Roberts.

Sincere thanks are extended to the many individuals and organizations who gave so generously of their time and talents to the project. Without such assistance and encouragement, the study could not have been successfully completed.

I am perhaps most indebted to Dr. Latham, who initiated the project and followed it closely to its conclusion. His inspiration and patient guidance was a constant source of assurance to the writer.

For permission to conduct habitat manipulating experiments in the Stone Valley Experimental Forest, I am grateful to M. K. Goddard, who at the time was Head of the Department of Forestry, Pennsylvania State University. Forestry Professors Dr. W. C. Bramble and O. A. Schmidt gave assistance in this phase of the project.

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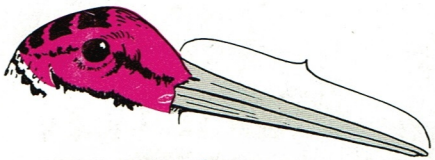
WOODCOCK SEX AND AGE CRITERIA

SEX

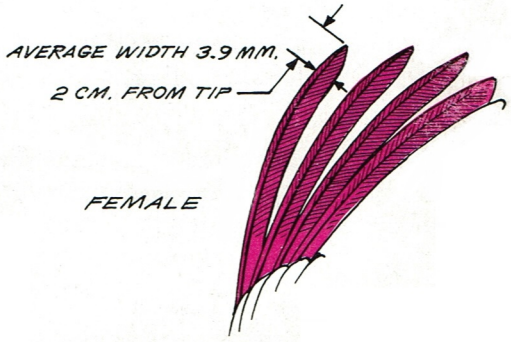
BILL LENGTH

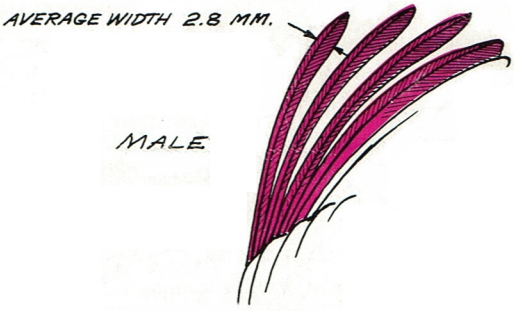


LENGTH IN MM'S (25.40 MM. = 1 INCH)

59, 60, 61, 62, 63	100% ♂
64, 65, 66	95% ♂
67, 68, 69	50% ♂ 50% ♀
70, 71, 72	95 ♀
73, 74, 75, 76, 77	100% ♀

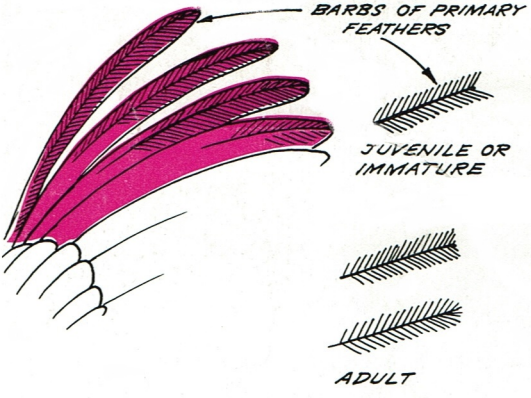
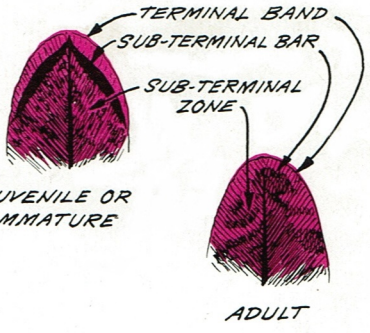
PRIMARY FEATHER WIDTH





AGE

PRIMARY FEATHER WEAR



SECONDARY FEATHER COLOR PATTERN